

Classification of Arrhythmia by Analysing Ecg Features

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Article Info

Page Number: 5936 - 5944

Publication Issue:

Vol 71 No. 4 (2022)

Abstract

The rate of heart disease is increasing at an exponential rate. Modern-day lifestyle and our ignorance of health have put the most important organ of our body Heart at great risk. Currently, India is witnessing a large number of young people suffering from Heart Disease. Prediction of heart disease is a difficult and risky task. Since it is directly dependent on people's health, accuracy is a major factor. Today, many hospitals maintain records of their patient's reports. This kind of framework generates an enormous amount of information that can be visualized. Moreover, this information can be used in the decision-making about Heart disease. The variation in heart rate from the normal rate indicates the abnormal behavior of the heart which is a symptom of heart arrhythmia. The proposed work is to develop a computerized diagnosis method for the detection and classification of heart arrhythmia by examining the ECG signal. The ECG signal analysis is a very simple, reproducible, and inexpensive method. The study concerns four types of arrhythmias databases from MIT-BIH data namely: Standard Arrhythmia ECG Data, CU Ventricular Tachyarrhythmia Database, Supraventricular Arrhythmia Database, and Ventricular Tachyarrhythmia Database. The performance is evaluated for different machine learning classifiers.

Article History

Article Received: 25 March 2022

Revised: 30 April 2022

Accepted: 15 June 2022

Publication: 19 August 2022

Keywords: Heart Diseases, ECG signals, Machine Learning Classifiers.

1. INTRODUCTION

According to World Health Organization (WHO), an estimated 17.3 million people died from heart disease in 2008 and this number of death will increase to reach 23.3 million by 2030. Hence heart diseases become a very concerning disease. By adopting a new method for early detection of heart

health, it becomes possible to reduce the number of death and prolong the length and quality of life [1-3].

Several parameters may lead to cause fatal damage to our vital organs such as the heart. These parameters and their related consequences may be life-threatening and may lead to the death of the person and hence need to be studied and addressed very minutely and carefully.

It is found that now a day there is a great risk of heart disease, especially in the case of patients with overweight and obese [4]. The occurrence and increase in the risk of heart failure are also due to the climatic conditions as there is more risk in the winter season and frequency and the chance of cardiac failure is more in the case of the patients with more blockages and the percentage also increases with the increase in the blockages. In many cases, it is also found that there is more failure due to ventricular dysfunction and also there is more chance of failure of heart disease increase of patients with a history of heart diseases [5-7]. The most frequent parameter is the mediatory changes that transfer from the parent to their children. The chance of developing heart disease is also due to the increase in stress levels and addiction such as smoking, chewing tobacco and uncontrolled drinking habits these things also promote the occurrence of heart diseases which may be moderate to very dangerous or highly dangerous [8-10]. One of the important reasons for the occurrence of heart disease which is found in most of the persons is due to the way of lifestyle they used to live. This means if the lifestyle is sedentary and there is a lack of exercise and sufficient walking. All of these issues are very important and to be considered in the analysis process for the prediction of heart disease [11].

The development of the system which will continue monitoring heart health using the different studied parameters involves the technical issues which are discussed here in this research. In addition to this analytical paper studies and identifies the different research issues regarding competition for heart health and different monitoring system suggested using the different parameters which will significantly improve the monitoring of heart health and overall health of the human being.

2. RELATED WORK

In many cases studying and identifying the abnormalities in the ECG signals is crucial from the medical point of view and saving the life of the person is very challenging sometimes. [1]

To identify the abnormalities in the ECG is to diagnose the ECG for the various types of impurities or the various types of noise elements present in the ECG and thereafter decide the quality of the

ECG signals for the detection of the various types of the heart and other related diseases. Many tools and techniques are also being developed which are used to monitor human health and the market is also full of such types of modern devices and has numerous verities in it. [2]

Health watches are very popular in the market and monitor the type of intake you take and count the heart pulses and heart rate also in various body positions. Such devices use machine learning and deep learning techniques for the application and processing of health data. It takes the average of the daily activities and also suggests advice accordingly. So, that you can make changes to your daily life and monitor your health [3]. Proper management of your heart and overall health has become a fashion in daily life. This is completely possible due to the different types of inventions in the algorithms in computer science and engineering which can play with all types of data which is available for processing. And take the decision accordingly or suggest the changes accordingly [4]. On the other hand, to make such a decision system has to learn several advanced algorithms in computer science and engineering which can handle, monitor, and deal with such a numerous variety of data. The data may contain images, audio (sound), graphics, and all different formats and forms of data and these advanced algorithms have to gather, analyze and process the data and finally give the suggestion accordingly to the human being. [5] These algorithms involve complex mathematical functions which can be possibly solved by computers only as they have to be solved within the stipulated time frame. Some of the algorithms and models are discussed here in this research.

Most of the heart monitoring systems evolved from the previous few years used advanced technology for providing facilities regarding the monitoring of heart health as well as the monitoring of the other vital organs and body fluids of the human body [12].

The rate of heart failure also depends upon many factors one of the factors is the degree of ventricular dysfunction. Another important reason why the chance of heart failure increases is hypertension and diabetes mellitus [13]. It is also found that there are more tendencies or more chances of developing increases related to the heart in the winter season when the temperature goes below 15 degrees. Also in many cases, it leads to the sudden death of the person and leads to the loss of life. Hence it is very important to manage heart disease, by making proper planning and lifestyle changes. The following table gives a detailed discussion of the different types of technologies used in the respective area of the heart and other related diseases and also the description of each technology.

Table 1 contains different heart disease prediction technology used.

Sr. No	Paper Title	Year	Technology Used	Description
1	Types and Frequency of Cardiac Arrhythmias in Patients with Heart Failure [15]	2014	Statistical data analysis	The study concludes that a large percentage of patients with heart failure had cardiac arrhythmias, and ventricular arrhythmias were the most frequent.
2	Personalized Wearable Systems for Real-Time ECG Classification And Healthcare Interoperability [16]	2017	Neural Network	The motivation behind the research was to combine a wearable ECG monitoring kit with real-time arrhythmia classification and prediction server, raise appropriate alarms and at the same time upload and log the events to electronics health records database
3	Cardiologist-Level Arrhythmia Detection With Convolutional Neural Networks [17]	2017	Convolutional Neural Networks	Key to the performance of the model is a large annotated dataset and a very deep convolutional network which can map a sequence of ECG samples
4	Arrhythmia Detection Using MIT-BIH Dataset: A Review [18]	2018	Review of various methods used for MIT BIH dataset	For higher performance two or more method are fused and are made to give better outcome.
5	Prevalence of Cardiac Arrhythmias Among Chronic Obstructive Pulmonary Disease Patients Admitted to Jimma University Medical Center [19]	2018	The prevalence of arrhythmia accounted for 50% and the magnitude of its types were classified	Routine ECG investigation should be performed at the setup to screen and initiate early management of Cardiovascular diseases including cardiac arrhythmias for better prognosis COPD patients which was inevitable and very common.

From the above discussion, it is very clear that the performance of each technology is different. When a comparison is made between different types of techniques there are different challenges as the parameters are considered as varied as they are application and situation-specific. Though these situations are different some of the constraints are very similar and can be evaluated over a single line of marking. Some of the methods found significant for the diagnosis of heart diseases using the ECG signals and must be used in the practical application.

3. PROPOSE SYSTEM

At the top of the right chamber of the human heart, an electrical signal is generated from the Sino Atrial node which stimulates the heartbeat [20]. The heart may experience an abnormal increase or decrease in its beat rate which is known as arrhythmia [21]. To detect this type of abnormality, an electrocardiogram (ECG) device that measures the variations in the electrical signals of the heart is used. As reported by the American Heart Association(AHA) "Each year about 295,000 emergencies medical services -treated out -of-hospital cardiac arrests occur in the United States" [21]. Thus, having an automated system that can diagnose heartbeats and offer early detection of arrhythmia would greatly help in preventing cardiac arrests, thus saving people who might face such abnormalities. Also, it can help cardiologists in monitoring heartbeat rates and deciding on the specific types of arrhythmia.

Various approaches are proposed earlier to perform automatic arrhythmia detection based on the characteristics of the ECG signal. Since automatic detection is a computer-aided task, the provision of the most significant features of ECG is very important by which accurate diagnosis is possible. The earlier approaches focused on various aspects some focused on preprocessing, some on feature extraction, and some on learning techniques. This work aims to develop a computerized diagnosis method for the detection and classification of heart arrhythmia by examining the ECG signal. The ECG signal analysis is a very simple, reproducible, and inexpensive method. The study concerns four types of arrhythmias databases from MIT-BIH data namely: Standard Arrhythmia ECG Data, CU Ventricular Tachyarrhythmia Database, Supraventricular Arrhythmia Database, and Ventricular Tachyarrhythmia Database. The performance is evaluated for different machine learning classifiers.

3.1 Data Set

The Physiological ECG signal use of this work is provided by the MIT BIH arrhythmia database [13]. The various ECG signals considered are as follows. These ECG signals are converted to image format.

- MIT BIH Images (Total 55 ECG Images)
 - a. Arrhythmia ECG Images: 45
 - b. Normal ECG Images: 10
- Types of Arrhythmia ECG Images Data (Total 175 ECG Images)
 - a. Standard Arrhythmia ECG Data:45 ECG Images
 - b. CU Ventricular Tachyarrhythmia Database:35 ECG Images
 - c. Supraventricular Arrhythmia Database: 18 ECG Image
 - d. Ventricular Tachyarrhythmia Database: 77 ECG Images

3.2 Methodology

The method for arrhythmia detection is implemented in MATLAB 2013a. The flowchart of the proposed methodology for the detection of arrhythmia data from normal data is shown in Fig. 1.

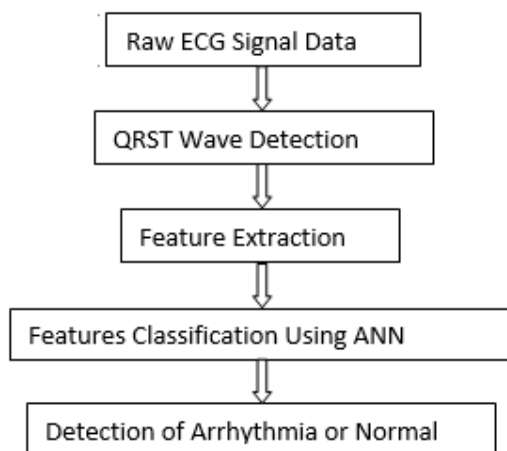


Fig. 1 Steps of Detection of Arrhythmia Using ECG

The whole methodology is divided into three basic parts: QRST wave detection, feature extraction, and classification. It can be seen that the raw ECG signal is offered for the detection of QRST waves. The original ECG signal should be pre-processed with the purpose of detecting Q R S T peaks of ECG and preparing this processed signal for the next stage. The next stage of the proposed model is feature extraction that is preparing the input which best characterize the original signal. Final step of the method is to classify the processed signal into the normal and arrhythmia class.

4.CONCLUSION

Using the discussed system, doctors and medical practitioners get the information about a schedule of medicines, drugs and other testing if required any. This will be helpful to Doctors to save and protect their patients from the life threatening heart diseases and also protect the human body from affecting the other organs. By accurate identification of diseases and providing correct diagnosis it will be a great help for the human life. Such a type of the advanced devices, not only saves the human life but also are helpful in decreasing the cost in the treatment of the heart diseases.

The main objective of this research is to propose a methodology which classify type of arrhythmia detected using machine learning algorithms along with features selection algorithm. It is expected that the research in this area and continuous development will eventually results in a several utilities of the proposed design. These strategies will also greatly increase the effectiveness and efficiency of the previous designs.

8. Acknowledgement

We want to express our gratefulness and onaccount of Ph.D. Department Computer Engineering,KBCs North Maharashtra University, Jalgaon.

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